

A REVIEW OF THE BATS OF THE GENUS HEMIDERMA.

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Apparently the first published account of bats which can be definitely referred to this genus is that given by Albert Seba in his *Locupletissimus rerum naturalium Thesaurus* published in Amsterdam in 1734. His description, under the name of *Vespertilio americanus vulgaris*, might be applicable to any one of a number of species of leaf-nose bats, and, indeed, was supposed for more than a century to refer to a species of another genus: but fortunately his original specimens are still preserved in the British Museum^a and their accurate identification is possible.

Seba's name is not binomial and has no standing at present in zoological nomenclature, but his description and figure were the basis for the Linnean species, *Vespertilio perspicillatus*, and hence the rediscovery of the original specimens is of very great importance.

DISTRIBUTION.

Bats of the genus *Hemiderma* are found in practically all parts of tropical and subtropical America, including the West Indies. They seem to be rare in these islands, as the extensive collections of West Indian bats in the United States National Museum contain no representatives of the genus. Three specimens from the island of Redonda are in the collections of the Academy of Natural Sciences of Philadelphia, and the only additional records of which I have any knowledge are those given by Dobson for Grenada and Jamaica. The most southern locality of which I have any record is Sapucay in central Paraguay, and the most northern is the State of Colima on the west coast of Mexico. Throughout most of this immense area some form of the genus appears to be one of the most common bats, and there are few local lists that do not record it.

^aThomas, Proc. Zool. Soc., Lond., 1892, p. 309.

HABITS.

In common with most other bats the habits of the *Hemidermus* are not well known. Charles Darwin writing of *H. perspicillatum*^a says: "On entering an old limekiln in the middle of the day I disturbed a considerable number of them; they did not seem to be much incommoded by the light, and their habitation was much less dark than that usually frequented by these animals." The eaves of houses and attics are not infrequently chosen as roosting places, though caves and hollow trees are also utilized. A collector who obtained some of these bats for the U. S. National Museum in northern Ecuador has recorded on his labels that some of the specimens were taken "under stones in the ditch." Another collector smoked more than a hundred bats of several species out of two hollow trees on the Tesechoacan River in Vera Cruz, and among the number were sixty-eight specimens of the form *H. p. aztecum*. Mr. E. T. Giers, who collected in Trinidad, records that these bats "roost in houses—bite animals." Whether this last observation is correct I am unable to say.

The breeding period is somewhat extended and probably lasts through half the year or even more. Messrs. Nelson and Goldman took half-grown individuals and pregnant females of *H. p. aztecum* at Tuxtepec, Mexico, on April 12 and 22, and half-grown young at the same place on October 24. In Ecuador young were taken at an elevation of 3,500 feet on March 14, while females containing small embryos and individuals three-fourths grown were taken at Trinidad on June 13. Nothing is known of the habits or breeding season of the smaller species *subrufum* and *castaneum*.

The young acquire many of the adult characteristics very early and measurements can not be relied upon to determine age. Measurements for a specimen from Vera Cruz (Cat. No. 123764, U.S.N.M.), which appears to be only a few days old, are as follows: Hind foot, 13 mm.; forearm, 37; tibia, 17; ear, 18; nose-leaf, 7; thumb, 12. The milk-dentition is just coming into place in the upper jaw, while in the lower jaw none of the teeth have cut the gum, though the canines and first premolars are visible through it.

VARIATION.

The variations within the several species of the genus are considerable and affect practically all of the characters. Color variations are so great as to almost exclude the value of color for specific determination. In one form (*H. p. aztecum*) the color ranges from dull sooty black to a bright ferruginous. In the other forms the observed variations are not quite so great. Considerable variation is also found

^a Under the name of *Phyllostoma grayi* Waterhouse, Mammalia of the Voyage of the *Beagle*, 1839, p. 3.

in cranial and dental characters. Two skulls from Maranhão, Brazil (Cat. Nos. 104575 and 104578, U.S.N.M.), differ so much in size and proportions that I should be inclined to regard them as belonging to different species if there were not intermediate specimens which bridge the difference.

NOMENCLATURE.

The following generic and specific names have been used:

GENERIC NAMES.

Vespertilio Linnaeus, Syst. Nat., 10th ed., p. 31. Linnaeus included *perspicillatum* in the genus *Vespertilio* in common with all other bats.

Phyllostoma Lacepede, Tabl. Divis. Sous divis. Ordres et Genres Mamm., 1799, p. 16. This genus was established for certain of the leaf-nosed bats, and *Hemiderma* was at first included in it.

Carollia Gray, Mag. Zool. and Bot., II, 1838, p. 488. Gray constituted this genus for the reception of "*Carollia braziliensis*" and "*Phyllostoma brachyotum* Pr. Max." It has been generally assumed that *C. braziliensis* and *P. brachyotum* are synonyms. Gray, however, applied the name *braziliensis* in manuscript to a species of the genus *Tonatia*, probably basing it on the same specimen that *C. braziliensis* was founded upon, and as it is the first-named species it appears that *Carollia* should rather be considered a synonym of *Tonatia*. However, the question does not affect nomenclature as *Carollia* is preoccupied by *Carollia*^a Cantraine, a genus of Mollusca.

Hemiderma Gervais, Exped. du Comte de Castlenau, Zoologie, p. 43, 1855. This name was proposed with *Hemiderma brevicaudum* Wied (= *H. perspicillatum*) as the type. Although Gervais figures the skull of a specimen from Bahia with complete zygomatic arches, his description is otherwise correct and applicable to this species and *Hemiderma* must stand as the valid name of the genus.

Rhinops Gray, Proc. Zool. Soc., Lond., 1866, p. 115. In this instance, as in many others, Gray failed to distinguish between generic and specific characters in his diagnosis and the description is in itself not determinable. Dobson, however, pronounced the type-specimen of *Rhinops minor*, which was made the basis of the genus, to be *Carollia brevicauda* (= *H. perspicillatum*). This opinion has been confirmed by Mr. Gerrit S. Miller, jr., who has kindly reexamined the specimen for me.

SPECIFIC NAMES.

perspicillatum (*Vespertilio*) Linnaeus, Syst. Nat., 10th ed., p. 31. This is the valid name for the South American form.

brevicaudum (*Hemiderma*) Wied, Schinz' of Thierreich, I, 1821, p. 164. This name was in current use for the South American species (and

^a I follow current usage in considering *Carollia* and *Carollia* to be the same name.

generally for all the forms of the genus) for eighty years. The rediscovery of Seba's specimens have shown that the name is a synonym for *perspicillatum*.

brachyotum (*Phyllostoma*) Wied, Schinz' Thierreich, I, 1821, p. 164. This name, originally proposed on the same page as the preceding, has been variously accredited to Wied's Beiträge zur Naturgeschichte Brasiliens (1826) and to Burmeister's Thiere Brasiliens (1854). The type could not be found by Professor Peters in 1865, and he was in some doubt as to whether the name was intended to refer to this species or to another. It appears to me that it was undoubtedly founded upon a dark phase of the same species as *brevicaudum*, and therefore it is also a synonym for *H. perspicillatum*. Indeed, it is difficult to tell from the lengthy description given by Wied in his Naturgeschichte just what differences he thought he distinguished between the two species.

soricinus (*Vampyrus*) Spix, Simiar. et Vespert. Brasil, 1823, p. 65, pl. xxxvi, figs. 2 and 6. One figure which Spix gives of his *Vampyrus soricinus* appears to be a *Hemiderma*, while the other, which he referred to the same species, is apparently a *Glossophaga*. Professor Peters examined the type which was from Rio de Janeiro, and pronounces it to be a *Carollia brevicauda* (= *Hemiderma perspicillatum*). The artist figured the skull with a complete zygomatic arch, although the text expressly states that the zygoma is incomplete.

grayi (*Phyllostoma*) Waterhouse, Voyage of the Beagle, 1839, Zoology, p. 3, pl. II. Waterhouse based his description upon specimens from Pernambuco. Peters and Dobson both place the name in synonymy with *C. brevicauda* (= *H. perspicillatum*).

calcaratun (*Phyllostoma*) Wagner, Archiv f. Naturgesch., I, 1843, p. 366. The first publication of this name has been generally accredited to the transactions of the Munich Academy, V, 1847, though in this citation Wagner refers to the original description in the Archiv for 1843. The type was from Brazil and the principal character noted is the extremely long calcar. Peters reexamined the specimen and found that what Wagner mistook for the calcar was in reality a portion of the interfemoral membranes which had become wrapped up in a stiff roll. On softening the membrane the calcar was found to be 7 mm. instead of 28, as given by Wagner.

verrucata (*Arctibeus*) Gray, List Mam. Brit. Mus., 1843, p. 19. This name was first published by Gray in the "List" without any description and with the habitat given as South America. In 1844 he republished the name,^a placing the species in the genus *Carollia* and stating that it differs from *C. brachyotis* in the larger ears and ovate, triangular, acute-tipped tragus. Dobson and Peters both examined the type and pronounce it to be *brevicaudum* (= *perspicillatum*).

^a Voyage of the Sulphur, Mamm., 1844, p. 20, pl. viii, fig. 3.

Mr. Gerrit S. Miller, jr., recently reexamined the specimen and made the following notes: "Adult skin, with the skull removed but not cleaned. Color rather dark, in no way characteristic. Forearm, 38.5 mm.; third finger, 82; foot, 11.8; tibia, 16; upper tooth row, 7.4." The small size here given would seem to indicate that the specimen may actually be a representative of a small South American form allied to *subrufum*, but in the absence of more definite data in regard to locality and skull characters it seems best to regard the name, at present, as a synonym of *perspicillatum*.

bicolor (*Phyllostoma*) Wagner, Schreber's Säugeth., Suppl., I, 1844, p. 400. Wagner here renames the *Vampyrus soricinus* of Spix (antedated by *Phyllostoma soricinum* Geoffroy.) His description does not show any characters by which the species can be distinguished from *P. brevicaudum* Wied which is described on the next page. The type was from Brazil and the name is a synonym for *perspicillatum*.

azteca (*Carollia*) Saussure, Rev. et Mag. Zool., 2me. ser., XII, 1860, p. 480, pl. xx, figs. 1, 1a. Saussure described this form from "Tropical and Temperate Mexico," giving as the principal character a lanceolate and pointed antitragus. After examining specimens of the genus from Mexico I cannot regard this character as having any value. The figure which Saussure gives of the tragus appears to have been drawn from memory some time after the specimens were last examined, while the figure of the feet resembles those of a *Glossophaga*. His measurements, however, serve to identify the species as the largest form of the genus known from Mexico. Peters, Dobson, and others have considered this to be identical with the South American species. Sufficient material is now at hand to show conclusively that it is a well-marked form, much larger than the South American bat, though connected with it by intermediate forms in Central America. *Azteca* therefore stands as the valid name for a form which is here recognized as a sub-species of *perspicillatum*.

minor (*Rhinops*) Gray, Proc. Zool. Soc., 1866, p. 115. No specific characters were given by Gray, but a new genus (*Rhinops*) was established and the type of the genus was given as "*Rhinops minor* sp. nov." Mr. Miller has recently reexamined the type for me and made the following notes upon it: "Type (49. 10. 15. 13.). [British Museum of Natural History.] Very young, milk incisors in place and permanent cheek-teeth not fully grown. Forearm, 35.5 mm.; foot, 11.7; tibia, 14.2. Color rather dark, in no way characteristic." The specimen was from Brazil and the name is a synonym of *perspicillatum*.

castaneum (*Carollia*) H. Allen, Proc. Amer. Philos. Soc., XXVIII, 1890, p. 19. This species, based upon a single alcoholic specimen, has been generally recognized by mammalogists. The species has

since been erroneously recorded^a from Panama, but an examination of the specimens on which this record was based shows that they belong to the form *aztecum*, and the type, which is from Costa Rica, remains unique.

subrufum (*Hemiderma*) Hahn, Proc. Biol. Soc. Wash., XVIII, 1905, p. 247. This name was proposed for the smaller species known from Mexico. As mentioned in the original description, it does not appear to intergrade with any other known form and must be regarded as a distinct species.

MATERIAL.

In the preparation of this paper 374 specimens have been examined, most of which are in the collections of the U. S. National Museum. My thanks are due to Dr. C. Hart Merriam, Chief of the Biological Survey, U. S. Department of Agriculture; to Dr. J. A. Allen, Curator of Birds and Mammals in the American Museum of Natural History; to Mr. Samuel Henshaw, Curator of the Museum of Comparative Zoology, Cambridge, Massachusetts, and to Mr. J. A. G. Rehn, of the Academy of Natural Sciences, of Philadelphia, for the loan of specimens.

Genus HEMIDERMA.

Size medium, but heavily built; tail short, entirely enclosed in the interfemoral membrane excepting the tip which forms a little knob on the upper surface; free border of interfemoral membrane deeply notched; ears moderate; nose-leaf thick and broad; chin with a large wart in the center and a V-shaped double row of smaller warts on the sides.

Skull heavily built; zygomatic arches incomplete; palate prolonged backward in center beyond the line of the teeth, forming a sort of tubular projection. Dental formula i. $\frac{2-2}{2-2}$, c. $\frac{1-1}{1-1}$, p. $\frac{2-2}{2-2}$, M. $\frac{3-3}{3-3}$ = 32. Middle upper incisors inclined toward each other at the tips, outer ones minute; middle lower incisors notched. Molars with a single internal cusp.

HEMIDERMA PERSPICILLATUM (Linnaeus).

Vespertilio perspicillatus LINNAEUS, Syst. Nat., 10th ed., 1758, p. 31 (based on *Vespertilio americanus vulgaris* SEBA, Locupl. rer. nat. Thes., 1734, p. 90).

Phyllostoma bernicaudum WIED, Schinz' Tierreich, I, 1821, p. 164.

Phyllostoma brachyotos WIED, Schinz' Tierreich, I, 1821, p. 164.

Vampyrus soricinus SPIX, Simiar. et Vespert. Brasil., 1823, p. 66, pl. xxxvi, figs. 2 and 6.

Phyllostoma brevicaudum WIED, Beitr. z. Naturgesch. Brasil., II, 1825, p. 192.—WAGNER, Suppl. Schreb. Säugeth., I, 1844, p. 401; V, 1855, p. 626.—BURMEISTER, Thiere Brasil., 1854, p. 41.

^a Bangs, Bull. Mus. Comp. Zool., XLVI, p. 213, Jan., 1906.

Phyllostoma grayi WATERHOUSE, Voyage of the Beagle, Mamm., 1839, p. 3, pls. XI and XXXV.

Phyllostoma lanceolatum TEMMINCK (mss.); Gray, List Mamm. Brit. Mus., 1843, p. 20.

Phyllostoma calcaratum WAGNER, Archiv f. Naturgesch., I, 1843, p. 366.

Carollia verrucata GRAY, Voyage of the Sulphur, Mamm., 1844, p. 20, pl. VII.

Hemiderma breviceaudum GERVAIS, Exped. du Comte de Castlenau Amer. Sud., Mamm., 1855, p. 43, pl. VII.

Carollia breviceauda PETERS, Monatsb. k. Preus. Akad., Berlin, 1865, p. 519.—DOBSON, Cat. Chiropt., 1878, p. 493.

Rhinops minor GRAY, Proc. Zool. Soc. Lond., 1866, p. 115.

Hemiderma perspicillatum THOMAS, Ann. and Mag. Nat. Hist., VIII, 1901, p. 192.

Hemiderma tricolor MILLER, Proc. Acad. Nat. Sci. Phila., 1902, p. 408.

Type-locality.—Not known. The type-specimen,^a a young female, is in the British Museum of Natural History, Lidth de Jeude collection, and is probably from northern South America.

Geographic distribution.—Probably the whole of tropical and subtropical South America, Trinidad, the Lesser and perhaps the Greater Antilles. The southern limit of its range, so far as known, is Sapucay, Paraguay. The species has been taken at sea level within two degrees of the equator and at an elevation of 3,500 feet in the same latitude. The northern limit may be considered to be Panama, where it begins to intergrade with the subspecies *aztecum*.

Characters.—Size, intermediate between *H. p. aztecum* and *H. subrufum*, nearest the former; external edge of maxillary tooth-row only slightly concave (never with an angular curve); teeth moderately heavy; mandibles and mandibular teeth light.

Pelage.—The character of the pelage, as well as its color, is extremely variable. In general the color is darker than in any other form of the genus, and fewer individuals in the red phase are to be found, while none that I have seen have the bright ferruginous tinge observable in some of the specimens of *aztecum*. *Hemiderma tricolor* was founded on specimens from Paraguay "similar to *Hemiderma perspicillatum*, but with fur longer and more silky in texture and the three color-bands on the hairs of the back strongly contrasted."^b These characters, however, do not prove to be distinctive, as the type of *H. tricolor* can be almost exactly matched by specimens at hand from Brazil, Trinidad, and Costa Rica, while two skins from Paraguay have short fur, reddish in color, and without strongly contrasted color-bands.

Fur and membranes.—Membranes blackish in color; interfemoral membrane sparsely furred at the base above and below, with a few

^aMr. Gerritt S. Miller, jr., has recently examined the type and made the following notes upon it: Female, not fully adult. Finger-joints not perfect, but milk-
dentation all gone. Head and body, 65 mm.; tibia, 17; foot, 11.5; forearm, 39.4; third finger, 82; ear, from crown, 13.4; thumb, 11.4.

^bMiller, Proc. Acad. Nat. Sci., 1902, p. 408.

minute hairs also scattered over the distal portion; legs and feet thinly covered with hairs, a number of stiff hairs at the base of the claws; forearms densely furred at base, the fur gradually becoming shorter and more sparse distally; base of thumb well covered with short hairs. Wing membranes from front of tarso-tibial joint, on a level with calcar.

Ear and tragus.—Ears rather short and broad; anterior edge strongly and evenly convex; posterior edge slightly concave in its upper two-thirds; outer side densely furred at base, naked at tip; internal side thinly haired at base; no distinct antitragus. Tragus variable, but usually acutely pointed; external edge with a more or less evident notch about one millimeter from the tip and three small lobes lower down, the upper one sometimes indistinct, the second thickened and glandular; internal edge slightly convex with a glandular swelling along the upper part.

Nose-leaf.—Nose-leaf broad, thick, tapering very sharply from the middle half to the tip, covered on both sides with minute hairs.

Skull and teeth.—Skull of medium size, but rather heavily built; brain-case rising abruptly from rostrum, broadly arched and wide, but not so wide relatively as in *H. subrufum*; interorbital constriction not pronounced; rostrum generally broad and flat, in certain specimens from Maranhão, Brazil, it is markedly narrow and pinched; teeth moderately heavy; the second upper premolar with a posterior elongation which, however, does not form a distinct heel or secondary cusp; teeth placed closely together, but not overlapping; line of maxillary tooth-row not sharply curved; last upper molar with or without a distinct posterior cusp. Mandibles light.

Specimens examined.—Total number 145, from the following localities:

Paraguay: Sapucay, 23.

Brazil: Sao Paulo, San Sebastio, 2; Maranhão, 10; Purus River, 1. Trinidad: 80.

Venezuela: Maripa, 2; Ciudad Bolivar, 2; San Julian, 2.

Ecuador: Paramba, 5; Pambilar, 4; San Javier, 4.

British Guiana: Berbice, 3.

Colombia: Santa Marta, 10.

West Indies: Redonda, 3.

Remarks.—This species appears to be the most generalized of any of the genus. Although the range here given includes practically all of South America, it is impossible to separate it into more than one form on the basis of the material now at hand. Specimens from Paraguay have a slightly smaller average size than those from farther north and also an average difference in color; but these differences are bridged by one or two specimens. The ten specimens at hand from Maranhão, Brazil, show a very great cranial variation, and, were there

no intermediates, I should unhesitatingly say that the extremes belong to two distinct species. The Ecuador specimens also show some variation from those from other localities, the rostrum being very broad and short, with the brain-case long and expanded basally. Skulls of the two specimens seen from British Guiana are larger than any others from South America, and in this respect approach the subspecies *aztecum*. Two adult specimens from the island of Redonda closely resemble those from Trinidad, whence they have undoubtedly been derived.

Table of average skin measurements, in millimeters, of *Hemiderma perspicillatum*.

Locality.	Number of specimens measured.	Hind foot.	Culcar.	Tibia.	Forearm.	Third metacarpal.	Third finger.	Fourth finger.	Fifth finger.	Thumb.	Ear.	Nose-leaf.
Sapucay, Paraguay	9	10.8	7	17	40.3	35.7	85	61.6	61.8	11.2	16.7	8.1
Brazil	10	11.1	7.5	18.9	40.3	36.7	86.2	59.3	58.6	11.4	16.7	8.8
Trinidad	10	12.2	7.3	18.7	41	39	89.4	62	61.5	13	18.5	8.5
British Guiana	2	12	7.5	18.5	42	39	89	61.5	63	14	19.5	8.5
Northern Ecuador	10	12	8.2	18.8	41.1	38.3	83	62.1	61	12.5	17	7

Table of average cranial measurements, in millimeters, of *Hemiderma perspicillatum*.

Locality.	Number of specimens measured.	Greatest length.	Basilar length.	Palatilar length.	Maxillary tooth-row.	Greatest breadth of brain-case.	Interorbital breadth.	Posterior palatal breadth.	Depth of brain-case from condyle.	Condylar-mandibular length.	Mandibular tooth-row.
Sapucay, Paraguay	8	22	17.3	9.5	7.5	10	5.8	7.7	8.9	14.5	8.7
Sao Paulo, Brazil	2	21.1	17.5	9.5	7	9.7	5	8	9.2	14.3	7.7
Maranhão, Brazil	5	21	16.7	8.9	7	9.5	5.1	6.9	8.2	14.1	8
Trinidad	5	22	17.5	10.2	8	10	5.8	7.8	9.2	14.5	9
Berbice, British Guiana	2	23	17.7	10	8.5	10.7	6	8	9.7	15	9
Ciudad Bolivar and Maripa, Venezuela	1	21.5	17	9.7	7.5	9.8	5	7.2	8.2	14.8	8.2
Minea and Bonda, Colombia	9	22	17	9.8	7.6	10	5.1	7.8	8.8	15	8.2
Paramba and San Javier, Ecuador	10	22	17.6	10	8	10.5	6	8.5	9.5	14.5	8.2

^aAs defined by Thomas.

HEMIDERMA PERSPICILLATUM AZTECUM (Saussure).

Carollia azteca SAUSSURE, Rev. et Mag. Zool., 2me ser., XII, 1860, p. 480, pl. xx, fig. 1.

Carollia brevicauda PETERS, Monatsber. K. Preus. Akad., Berlin, 1865, p. 520.—DOBSON, Cat., 1875, p. 492.—TROUENART, Cat., 1897, p. 156.

Hemiderma brevicauda MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, 1901, p. 283.

Hemiderma perspicillatum ELLIOT, Pub. Field Col. Mus., Zool. Ser., IV, Pt. 2, p. 668, figs. 141, and cxv; Zool. Ser., VI, p. 515.

Type-locality.—Temperate and tropical Mexico. Not definitely known.

Geographic distribution.—The hot, humid regions of southern Mexico and Central America from Panama as far north as Orizaba; exact limits of distribution not known.

Characters.—The largest known form of the genus (forearm, 42–44 mm.; skull about 23 mm.); skull large and massive, with high, broad brain case, and heavy teeth; ear, nose leaf, and tragus high, thick, and heavy.

Pelage.—Fur dense, but short. Color more variable than in any of the other forms of the genus. Some specimens from the lowlands of the Rio Tesechoacan, in southern Vera Cruz, are bright ferruginous in general appearance, the hairs being darker (near the mars brown of Ridgway) on the basal third, the central band having the characteristic color, and this in turn being minutely tipped with bright chestnut. Other specimens from the same locality are much darker in color. Skins from Tuxtepec, Oaxaca, have the proximal color band buffy white, and this is concealed by about 4 mm. of bright hazel, which gives the predominant tint to the fur when not disarranged. Certain specimens from Costa Rica are still darker, having the basal and outer bands of a sooty color near the clove brown of Ridgway, while the central band is grayish white.

Membranes.—The membranes differ in no essential manner from typical *H. perspicillatum*.

Ear and tragus.—The ear is higher than in the typical form, with the anterior edge less convex and the tip less broadly rounded. Tragus slightly higher and broader.

Nose leaf.—The nose leaf is wide and tapers more gradually to the tip than in *H. perspicillatum*.

Skull and teeth.—Skull long and heavy, with a high, broadly arched brain case, which slopes gradually to the elongated and broad rostrum; palate broad; basal region of the skull massive; interorbital constriction angular; zygomatic process of the maxillary heavy. Teeth large, but the internal cusps of the molars relatively small; canines, premolars, and middle incisors very heavy; internal cusps of the first molar rounded and less angular than in *perspicillatum*.

Specimens examined.—Total number 177, from the following localities:

Panama: Panama, 7; Boqueron, 6; Colon, 9.

Costa Rica: Monte Redondo, 3; Juan Viñas, 2; San Sebastian, 2.

Nicaragua: Escondido River, 50 miles from Bluefields, 12.

Mexico: Apazoté near Yohaltun, Campeche, 2; Jaltipan, 13; Rio Tesechoacan, near Perez, Vera Cruz, 68; Buena Vista, 1; Tuxtepec, Oaxaca, 51.

Remarks.—“*Carollia aztecum*” was described by Saussure from “temperate and tropical Mexico,” the principal character assigned to it being a “lanceolate and pointed antitragus.” This was doubtless due

to the drying of the skins in an abnormal position, as he himself suggests, for I have not seen any such character in the specimens examined. His figures of the tragus and of the legs and membranes are characterless. But, fortunately, his measurements serve to show that the species he had was neither *subrufum* nor *castaneum*, and the name is therefore adopted for the only other known form from that region. No definite type locality is assigned in the original description, which implies that specimens were examined from more than one locality. Among the specimens examined by the present author those from the lowlands of the eastern coastal region of southern Mexico show the greatest amount of differentiation from the typical *perspicillatum*, and, as it seems quite probable that some of Saussure's specimens may have come from that region, specimens from Rio Tesechoacan, near the town of Perez, in Vera Cruz, are assumed, for the purposes of this paper, to be typical.

Central American specimens are intermediate between those from Vera Cruz and Oaxaca and those from South America. Should the accumulation of more material from that region show that these differences are marked and constant it may become necessary to separate them as another subspecies, but such a course does not seem advisable at the present time in view of the great variations which are found among specimens from the same locality.

Average skin measurements, in millimeters, of Hemiderma perspicillatum aztecum.

Locality.	Number of specimens measured.	Hind foot.	Calc. ar.	Tibia.	Forearm.	Third metacarpal.	Third finger.	Fourth finger.	Fifth finger.	Thumb.	Ear.	Nose leaf.
Colon, Panama	9	12.4	7.1	19.8	41.9	38.3	88.6	62	60.8	11.3	17	7.3
Panama, Panama	6	12	7.5	.....	42	40	94	64	66	14.5	19	.....
Nicaragua	9	13	7.8	19	42.2	39	89	64	64	12.5	18.3	8
Rio Tesechoacan, Vera Cruz.	13	12.9	8.5	20.3	43.7	39.5	93.5	64.1	65	13.5	19	8
Tuxtepec, Oaxaca	11	12.7	9	20.5	44	39	90.3	63.4	64.3	12.6	19.5	8.2
Apazote, Campeche	2	14.5	10	19.5	43.5	41	.....	.....	.....	14	17.5	7.5
Jaltipan	13	14	9.5	19	43	41	.....	.....	.....	14	17.7	7.3

^a Measurements taken from dry skins.

Average cranial measurements, in millimeters, of specimens of *Hemiderma perspicillatum aztecum*.

Locality.	Number of specimens measured.	Greatest length.	Basilar length.	Palatilar length.	Maxillary tooth row.	Greatest breadth of brain case.	Interorbital breadth.	Posterior palatal breadth.	Depth of brain case from condyle.	Condylar-mandibular length.	Mandibular tooth row.
Tuxtepec, Oaxaca, Mexico.....	8	24	18.2	10.2	8.2	10.3	5.8	8.2	9.2	16.2	9
Río Tesechoacan, Vera Cruz.....	6	24	.....	10	8.2	10.5	6	8.2	9.3	15.8	9
Costa Rica.....	2	23.5	19	11	8.8	10.8	5	9	9	.....	.....
Yohaltun, Campeche.....	3	24.2	19.5	10.2	8.5	11	5.5	10.5	9.5	15.7	10
Colon, Panama.....	3	22.3	18	10	8	10.5	6	12.5	9.5	.....	.....
Boqucon, Panama.....	6	21.8	17.8	10	8	10.1	5.5	8.8	8.8	15.2	8.7
Panama, Panama.....	6	22.6	17.5	9.8	8	10	5.1	8	9	15	8.3

HEMIDERMA SUBRUFUM Hahn.

Hemiderma subrufum HAHN, Proc. Biol. Soc. Wash., XVIII, Dec. 9, 1905, p. 247.

Type-locality.—Santa Ifigenia, near the west coast of Oaxaca, Mexico. (Type-specimen, skin and skull, Cat. No. 75, 127, U.S.N.M., Biological Survey Collection.)

Geographic distribution.—Southern Mexico. Limits of distribution not known.

Characters.—Size intermediate between *Hemiderma perspicillatum* and *H. castaneum* (forearm about 39 mm.); skull small and short (about 21) with a high, strongly arched brain-case; maxillary tooth-rows with an angular curve between the premolars so that they are strongly divergent posteriorly; second premolar with a distinct posterior process.

Pelage.—The fur is short and sparse and rather coarse. "Ten skins from the type locality are uniformly of a dark reddish-brown color above. The individual hairs are banded as follows: A very short (not over $\frac{1}{2}$ mm.) basal area whitish; next a wider band of dark (near the clove brown of Ridgway) which is followed by another and wider band of buffish white; succeeding this is the somewhat narrower band of reddish prout's brown which gives to the animal its characteristic color; hairs minutely tipped with whitish. Underparts similar, but the bands of color less sharply marked off, the dark bands being reduced and the pale areas suffused, making the general color paler and duller." Specimens from near Yohaltun, Campeche, are slightly darker, while some from Achotal, Vera Cruz, in the collection of the Field Columbian Museum are more pallid, due to the fact that the central pale band of the hairs is wider and the outer band of prout's brown less reddish. The forearm is densely furred at the base, the hairs becoming shorter and more scattered distally, but the fur is more dense on the distal half than in *perspicillatum* or *aztecum*. Tibia sparsely covered with short hairs.

Membranes.—The membranes are thinner and more brownish than *perspicillatum*; wing membranes usually from distal end of tibia slightly above the level of the calcar, the position of attachment varying somewhat. Calcar weak.

Ears and tragus.—Ears narrow and pointed, the edges comparatively straight. Tragus variable, essentially as in *perspicillatum*.

Nose-leaf.—Nose-leaf narrow and thin, tapering gradually to the tip.

Skull and teeth.—Skull small, with a high, strongly rounded brain, case and short, broad rostrum; palate wide posteriorly, narrowed anteriorly. Teeth small, the canines and premolars being especially reduced; longitudinal axis of the second premolar not in a plane parallel to that of the first premolar and canine, but with the anterior edge turned in so that there is a distinct angle in the line of the tooth row at that point; second premolar with a distinct posterior process or heel; internal cusp of first molar relatively large. Mandibles and mandibular teeth small and weak; the lower edge of the mandibles without a distinct downward curve at the symphysis; coronoid process only slightly anterior to condylar process.

Specimens examined.—Total number 55, from the following localities, all in Mexico:

Colima: Hidalgo Magdalena, 7.

Oaxaca: Santa Ifigenia, 20.

Vera Cruz: Otatitlan, 1; Minatitlan, 1; Coatzacoalcos, 1; Mirador, 2.

Campeche: Apazote, near Yohaltun, 21.

Yucatan: Merida, 1.

Honduras: Patuca River, 1.

Remarks.—*Hemiderma subrufum* is in a way intermediate between *H. perspicillatum* and its subspecies, *aztecum* on the one hand and *H. castaneum* on the other, though apparently not intergrading with either. From the former it differs in its smaller size and lighter dentition and smaller and differently shaped skull; *castaneum*, on the other hand, is much smaller and has the cranial and dental peculiarities of *subrufum* carried to the extreme.

Table of average skin measurements, in millimeters, of *Hemiderma subrufum*.

Locality.	No. of specimens measured.	Hind foot.	Calcar.	Tibia.	Forearm.	Third metacarpal.	Third finger.	Fourth finger.	Fifth finger.	Thumb.	Ear.	Nose-leaf.
Santa Ifigenia, Oaxaca.....	5	12.1	7.1	16.7	39	36.7	86	60	60	13.7	17.7	8
Hidalgo Magdalena, Colima.....	7	12.4	6.9	17	39.9	34.9	81	57	58	12.4	16.5	7
Apazote, Campeche.....	4	12	7.2	16	38	36	88	62	62	13	16.2	7
Patuca River, Honduras.....	1	13	7	17	39	38	88	62	62	15	17	8

α Measurements from dried skins.

Table of average cranial measurements, in millimeters, of *Hemiderma subrufum*.

Locality.	Number of specimens.	Greatest length.	Basilar length.	Palatal length.	Maxillary tooth-row.	Greatest breadth of brain-case.	Interorbital breadth.	Posterior palatal breadth.	Depth of brain-case from Condyle.	Condylomandibular length.	Mandibular tooth-row.
Hidalgo Magdalena, Colima.....	4	21.5	17	10	7.2	10	5.5	7.8	8.2	14.5	7.2
Santa Ifigenia, Oaxaca.....	9	20.8	16.8	9.8	7	10	5.7	7.8	7.8	14	8
Yobaltun, Campeche.....	2	21.2	17	10	7.2	10	5.5	9	9	14.5	8
Patuca River, Honduras.....	1	22	17	9.5	8	10.5	6	9	9	.....	.....

HEMIDERMA CASTANEUM (H. Allen).

Carollia castanea H. ALLEN, Proc. Am. Philos. Soc., XXVIII, 1890, p. 19, read Dec. 6, 1889, printed Feb. 25, 1890, fig.—; Proc. U. S. Nat. Mus., XIII, 1895, p. 292, Nov. 15.

Hemiderma castaneum TROUESSART, Cat. Mamm., 1897, p. 157.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, 1901, p. 233.—ELLIOT, Field Col. Mus. Pub., Zool., 4th Ser., p. 670; VI, p. 516.

Type-locality.—Costa Rica (Type-specimen, Cat. No. $\frac{12914}{36384}$, U.S.N.M., male adult preserved in alcohol, with skull removed).

Geographic distribution.—Known only from the type-locality.

Characters.—The smallest species of the genus (forearm, 35 mm.); skull short (about 20), relatively broad, and lightly built, zygomatic processes of the maxillary long and slender; teeth small, the outer edge of the last upper premolar on a line with the internal cusp of the first molar.

Fur and color.—Doctor Allen says in the original description: "Fur long and silky. Above, lustrous light chestnut brown at basal one-half and at the tip. The intervening portion is yellow brown (old gold). Below the same colors prevail, excepting that over the abdomen and pubis the brownish tip is absent and the body of the hair is not golden." Since this was written the skin has been immersed in strong alcohol for sixteen years and the bands of color are no longer distinct, but the rich golden chestnut tinge is still evident. This is probably an individual character, however, as it can be almost exactly matched in specimens of *aztecum* from Vera Cruz which differ from it very markedly in size and cranial and other characteristics. The distribution of the fur upon the limbs and membranes can not be determined, as they have been rubbed, but there is still a little fur at the base of the thumb and on the toes; interfemoral membrane well furred above on the basal half.

Membranes.—Membranes, brownish; the wing membrane arising from the distal end of the tibia, the interfemoral membrane from the tarsus about 1 mm. lower. Doctor Allen states that the interfemoral

membrane is not incised. It has been stretched so that this point can not now be definitely determined, but I strongly suspect that it is incised as in other members of the genus and that its stretched condition (which enables one to draw the hinder edge out straight) caused Doctor Allen to err. Calcar very slender and weak.

Ears and tragus.—Ear deeply emarginate on outer border;^a inner border not as convex as in other species and tip blunt. The tragus is triangular in outline, with the glandular swelling of the inner edge less evident than in any of the other species; outer edge notched as in other forms except that there is no "shoulder" near the tip, while there is such a one near the tip on the inner side, something I have not seen in any other specimen that I have examined.

Nose-leaf.—The nose-leaf is long and slender, brown in color except at the tip and the upper margin, which are pale (possibly from being rubbed).

The chin has been described and figured as having warts arranged in the usual way, but it has now been so stretched and rubbed that they can not be distinguished.

Skull and teeth.—Skull short and relatively broad; brain-case low and widely arched; audital bullæ small; zygomatic processes of the maxillary long and slender. Teeth essentially as in *H. subrufum* in structure, but all of them smaller and their arrangement somewhat different; lines drawn along the outer edges of the canine and premolars of the two sides of the upper jaw would be about parallel and would cut off the inner cusp of the first molar; the outer edge of the first upper molar projecting considerably beyond the outer edge of the last premolar so that there is a sudden break in the line of the tooth-row; a space between the first and second premolars of both jaws. Other jaw teeth all close together.

Remarks.—*Hemiderma castaneum* is the most aberrant form of the genus, differing from all the other known forms in its small size and slender build, in the form of the ears and of the maxillary tooth-row, and in the long, slender zygomatic process. The type is a young adult male with unworn molars, but it is much smaller than specimens of other species which are far more immature.

Mr. Outram Bangs has recorded the species from Panama,^b but the specimens, which are in the Museum of Comparative Zoology at Cambridge, prove to have been erroneously identified and the type remains unique.

^aOne ear has been stretched out smooth and when opened backward and laid on the head it appears to be very slightly emarginate; the other is contracted by a number of oblique and transverse ridges radiating from a point about 10 mm. below the tip, which contract the outer edge at that point to form a deep notch. This wrinkled condition appears to have been the normal one during life.

^bBull. Mus. Comp. Zool., XLVI, p. 213, Jan., 1906.

Measurements of the type: Hind foot, 11 mm.; calcar, 6; tibia, 14; forearm, 35; third metacarpal, 34; third finger, 82; fourth finger, 58; fifth finger, 57; thumb, 12; ear, 14; nose-leaf, 6. Cranial measurements of type: Greatest length, 20; basilar length, 16; palatilar length, 8; maxillary tooth-row, 6.5; greatest breadth of brain-case, 9; interorbital breadth, 5; depth of brain-case from condyle, 8; condylo-mandibular length, 13; mandibular tooth-row, 7.